
Impact of hospital volume on the economic value of computer navigation for total knee replacement

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Record Status

This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary

The aim was to examine the impact of hospital volume on the cost-effectiveness of computer-assisted surgery (CAS) in elderly patients with end-stage arthritis of the knee, requiring total knee replacement. The authors concluded that CAS was cost-effective for centres with a high volume of joint replacements. Overall, the reporting was not comprehensive and caution is required when judging the validity of the authors' conclusions.

Type of economic evaluation

Cost-utility analysis

Study objective

The aim was to examine the impact of hospital volume on the cost-effectiveness of computer-assisted surgery (CAS) in elderly patients with end-stage arthritis of the knee, requiring total knee replacement (TKR).

Interventions

The two interventions were conventional TKR without computer navigation, and CAS.

Location/setting

USA/hospital.

Methods

Analytical approach:

This economic evaluation was based on a Markov model with a lifetime horizon. The authors reported that the perspective was that of the health care payer.

Effectiveness data:

Most of the clinical data were derived from a selection of relevant sources, including Medicare databases. The inputs on revision rates were derived from a 5% systematic Medicare sample of eligible patients from 1997 to 2004. The age-specific mortalities were taken from US life tables. The death rates associated with the surgical procedure came from a study of 124,986 primary total knee arthroplasties and 11,726 revision knee arthroplasties found in the 2000 Medicare database. The primary endpoint was the reduction in revision rates with CAS compared with conventional TKR.

Monetary benefit and utility valuations:

The utility values were derived from published data for joint arthroplasties, including a Swedish registry. No other details were reported on the instruments used to elicit patient preferences.

Measure of benefit:

Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:

The economic analysis included the costs of primary and revision TKAs and computer navigation. These costs were derived from the Massachusetts General Hospital billing department and Diagnosis Related Groups. The costs of the navigation computer, computer software, and service contract were taken from the vendor. These costs were spread over the expected survival of the equipment and the software (five years). The data on resource consumption were not

reported. All costs were in US dollars (\$) and were discounted at an annual rate of 3%. The price year was 2007.

Analysis of uncertainty:

A two-way sensitivity analysis was undertaken to examine the relationships among number of cases per year, annual cost of computer navigation, revision rates, and cost-effectiveness of CAS.

Results

The results focused on the relationship between hospital volume (number of cases per year) and cost-effectiveness in three typical centres of different sizes. CAS was cost-effective at a threshold of \$50,000 per QALY, in centres where 250 arthroplasties were performed per year, if the annual revision rate was reduced by 2% per year over a 20-year period. In those performing 150 arthroplasties, it was cost-effective if the revision rate was reduced by 2.5% and, in those performing 25 arthroplasties, it was cost-effective if the rate was reduced by 13%.

The sensitivity analysis showed that, in a centre performing 250 arthroplasties per year, the revision rate for CAS to be cost-effective, dropped from 3% when the annual cost of computer navigation was \$80,000, to 1.8% when the annual cost was \$48,000, and to less than 1% when the annual cost was only \$20,000. Thus, the cost of the computer navigation had a strong impact on the cost-effectiveness results.

Authors' conclusions

The authors concluded that CAS was cost-effective for centres with a high volume of joint replacements, where the decrease in the rate of knee revision needed to make the investment cost-effective was modest.

CRD commentary

Interventions:

The comparators were appropriately selected and included the current practice in several medical centres.

Effectiveness/benefits:

The clinical data were obtained from selected administrative databases, which are usually representative of large samples of patients. Few details on the characteristics of these databases were reported. The authors stated that these estimates were generally consistent with those reported in a Swedish registry. The measure of benefit was appropriate as QALYs capture the impact of the interventions on quality of life. The derivation of the utility estimates was not described in detail.

Costs:

The categories of costs reflected the payer's point of view, but the methodology used to calculate the total costs was not described in detail. There was no breakdown of the unit costs and no information on resource consumption. The price year was reported. Discounting was appropriately carried out in accordance with published guidelines.

Analysis and results:

The expected costs, benefits, and cost-utility ratios were not reported. The analysis considered only the relationship between the cost-effectiveness threshold and hospital volume. Although this was the primary objective of the study, more details on the cost-utility results would have been useful for improving the external validity of the analysis. The issue of uncertainty was only partially addressed using a deterministic approach, which focused on specific model inputs. The results of the sensitivity analysis were reported only in a diagram.

Concluding remarks:

Overall, the reporting was not comprehensive and caution is needed when judging the validity of the authors' conclusions.

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Bibliographic details

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Other publications of related interest

Bauwens K, Matthes G, Wich M, Gebhard F, Hanson B, Ekkemkamp A, Stengel D. Navigated total knee replacement. A meta-analysis. *Journal of Bone and Joint Surgery. American volume* 2007; 89: 261-269.

Katz JN, Barrett J, Mahomed NN, Baron JA, Wright RJ, Losina E. Association between hospital and surgeon procedure volume and the outcomes of total knee replacement. *Journal of Bone and Joint Surgery. American volume* 2004; 86: 1909-1916.

Novak EJ, Silverstein MD, Bozic KJ. The cost-effectiveness of computer-assisted navigation in total knee arthroplasty. *Journal of Bone and Joint Surgery. American volume* 2007; 89: 2389-2397.

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